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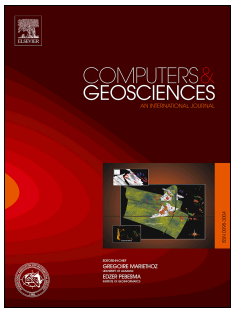


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# In Situ Visualization and Data Analysis for Turbidity Currents Simulation

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**Abstract**

Turbidity currents are underflows responsible for sediment deposits that generate geological formations of interest for the oil and gas industry. `libMesh`-sedimentation is an application built upon the `libMesh` library to simulate turbidity currents. In this work, we present the integration of `libMesh`-sedimentation with in situ visualization and in transit data analysis tools. DfAnalyzer is a solution based on provenance data to extract and relate strategic simulation data in transit from multiple data for online queries. We integrate `libMesh`-sedimentation and ParaView Catalyst to perform in situ data analysis and visualization. We present a parallel performance analysis for two turbidity currents simulations showing that the overhead for both in situ visualization and in transit data analysis is negligible. We show that our tools enable monitoring the sediments appearance at runtime and steer the simulation based on the solver convergence and visual information on the sediment deposits, thus enhancing the analytical power of turbidity currents simulations.

*Keywords:* Turbidity currents; in situ visualization; in transit data analysis; adaptive mesh refinement and coarsening; parallel computing

## 1. Introduction

Turbidity currents are particle-laden underflows where the main driver is turbulence. According to Meiburg and Kneller [1], turbidity currents Reynolds number in nature is of $\mathcal{O}(10^9)$. Thus

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